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WindSpeed Decision Support System (DSS), a planning instrument to reduce conflicts between offshore wind parks and environmental concerns

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Abstract

Offshore wind energy has the potential to provide a large share of Europe's future electricity demand. Unless adequately addressed, environmental concerns and other uses of the sea could make a large scale development of offshore wind energy difficult. The GIS-based Decision Support System developed within the EU-project WindSpeed (www.windspeed.eu) can help to analyse a realistic potential for offshore wind energy by including environmental concerns as wells as relevant sea use functions, and their interactions. For the Southern and Central North Sea, natural values are taken into account to analyse suitable areas for the development of Offshore Wind Parks (OWP). A resulting map shows regions that are generally suitable, not suitable or negotiable for OWP.

Objectives

Within the WindSpeed project the objectives are to

1. Show a realistic potential of offshore wind energy in the Central and Southern North Sea with high spatial resolution (5x5km²) taking into account non-wind sea functions and nature conservation constraints.
2. Determine the best possible strategy for the deployment of offshore wind energy.

The parameters used for this analysis are:

WIND / COST	NON-WIND
Planned / Existing OWP	Nature Conservation Areas
Designated OWP zones	Fishery / Fish / Spawning Areas
Wind speed at 90m	Benthos
Sea Depth	Military Use
Spring Tidal Amplitude	Shipping Routes/Density
Storm Surge	Platforms
Wave Height	Pipelines
Drilling Requirement	Cables
Grid Connection Points	Sand Extraction / Dredging
Staging Ports	

In the following the focus will be on aspects concerning the environment.

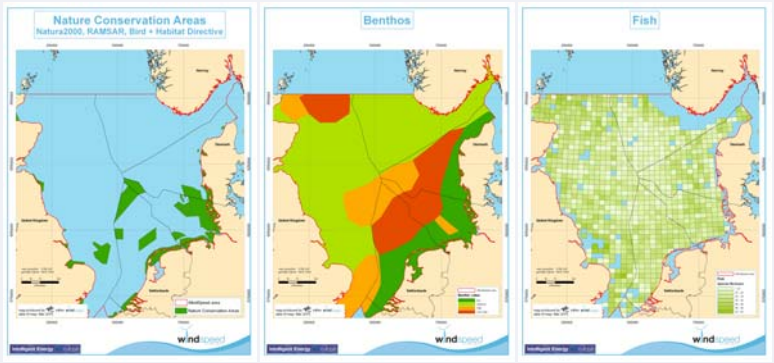
Methods

1. Identify, collect and collate existing data. For nature aspects the following information was used:

a) Nature Conservation Areas which are base on RAMSAR Convention, Bird Directive and Habitat Directive and Natura2000 sites. [1]

b) Benthos: based on a combination of benthic habitat maps for Germany, the Netherlands and Belgium, and extrapolated to the UK, Norway and Denmark by incorporating information on water depth and sediment composition. [1]

c) Fish: Species Richness: based on results for several years from the regular BTS and IBTS surveys. [1 and 2]



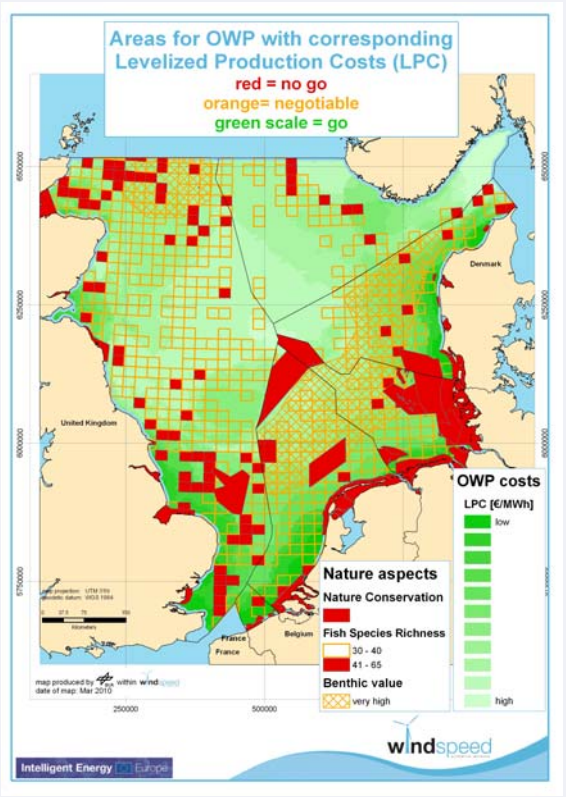
2. Combine all available data and apply calculation rules to identify available areas for OWP. Some rules are set up for nature aspects are as follows:

- Nature Conservation Areas: No go for OWP
- Benthos: low, medium and high: go; very high: negotiable
- Fish species richness: 'No go' for areas with highest fish biodiversity (>40 species) to preserve, negotiable (but widely available) for areas with 30-40 species, go for the remainder.

3. Calculate of Levelized Production Costs. Based on cost assumptions for a wind farm size of 600MW, Levelized Production Costs (LPC) are calculated for each 5x5km² grid cell. [3]

Results

By combining all data and applying the calculation rules three categories can be identified: 1) areas that are restricted by nature conservation constraints and by high fish species richness, 2) negotiable areas having less fish species richness and very high Benthos values, and 3) remaining areas that are generally suitable for OWP. The figure below shows all negotiable as well as suitable areas together with their corresponding Levelized Production Costs for OWP.



Conclusions

When addressing only environmental aspects (i.e. not taking into account non-wind sea use activities), the calculations rules applied in this example would suggest around 1/5 of the area to be 'out-of-bounds' (no-go) for OWP development. The remaining area would be roughly divided between (1) non conflict areas and (2) areas where some degree of conflict between environmental concerns and OWP would arise, and therefore subject to a closer look at trade-offs and negotiation.

WindSpeed DSS calculation rules for nature conservation areas and natural values (Benthos and Fish) can be modified to reflect different values and priorities, and do not necessarily exclude any area 100% from the use of OWP. They merely distinguish between more or less suitable areas for OWP development. An online interface of the DSS will be available soon at www.windspeed.eu.

References

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